

# ***MICROBIAL INTERACTION***

- The inter- and intra-relationships between various microorganisms which can include both positive (like SYMBIOSIS) and negative (like ANTIBIOSIS) interactions. Examples include virus - bacteria and bacteria - bacteria.
- The consortium may be in intermitent, cyclic or permanent.
- These are ubiquitous, diverse and critically important in the function of any biological community.

□ These includes-

○ Neutralism

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○ Mutualism

○ Commensalism

○ Parasitism

○ Cooperation

○ Predation

○ Amensalism

○ Competition

○ Synergism

# *NEUTRALISM*

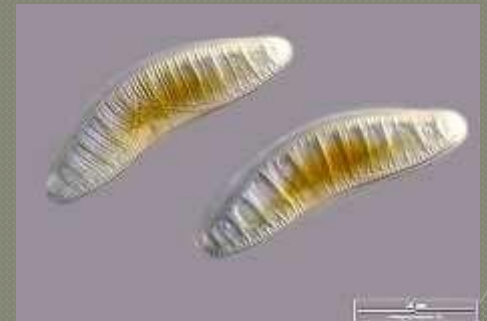
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- ❑ Microorganisms have no effect on each other.
- ❑ Observed in natural communities if-
  - ❑ Culture density is low.
  - ❑ Nutrient level is high.
  - ❑ Each culture has distinct requirements.

# Mutualism

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- An obligatory relationship.
- Highly specific.
- They operate as a single organism.
- Both organisms benefit.
- For Eeg. Diatom (*Climacodium*)
- and cyanobacteria (*Epithemia tur*)
- Lichen-Fungi with Cyanobacteria.





*Xanthoparmelia substrigosa* (foliose)



*Usnea*  
(fruticose)



*m*

The endosymbionts are visible as round bodies within the cytoplasm. endosymbionts are important in fixing atmospheric nitrogen for use by the cells.

# Cooperation

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Positive but not obligatory symbiosis  
Can be separated from one another.  
For eg-*Desulfovibrio* &  
*Chromatium*, *Cellulomonas* &  
*Azotobacter*



# Commensalism

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One partner(commensal) benefits.  
while other(host) remains unaffected.

- Common among organisms, not obligatory
- Unidirectional
- Usually, unaffected population modifies the environment in a way that other population benefits.

For eg-during Nitrification ,oxidation of  $\text{NH}_4^+$  ions get convert into nitrate.

*Nitrosomonas* convert  $\text{NH}_4^+$  ions to nitrite and *nitrobacter* oxidise nitrite into nitrate.



# Parasitism

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- One species is dependent on another for nutrition and growth.
- In it, one organism is benefitted and other is harmed.
- Closely related to predation.
- Coexistence between host and parasite.
- For eg- Viruses are the highly specialized intracellular *parasites, generally kill the host.*

# Cont....

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*cell. Myxococcus xanthus and E.coli.*

Microbial parasite may kill the host or can have stable relationship without killing the host. (lysogeny provirus is carried on host chromosome).

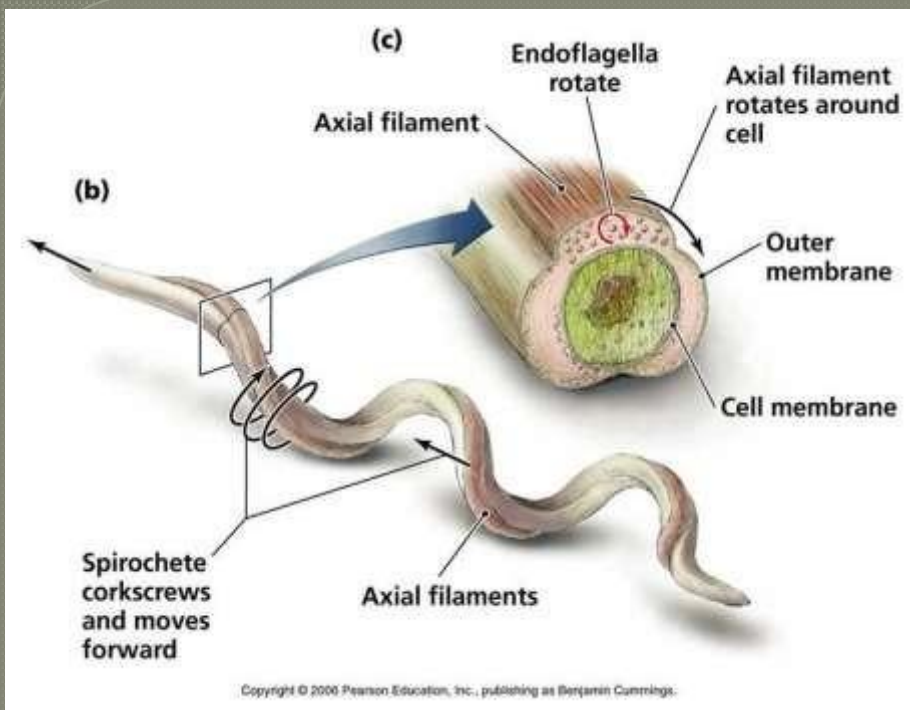
Pathogenic parasite may attack and kill the plant or animal host.

Obligate parasite *Treponema pallidum* (syphilis), *Rickettsia* (Rocky mountain fever) can't grow without an appropriate host.



Predatory behavior of *M. xanthus*

The *M. xanthus* swarm expands from the initial spot in a tangled motility pattern.  
Lysis ...



### Spirochaetes: Genus Treponema

- **Genus: Treponema:** *Treponema pallidum*, causes syphilis (sexually, or congenitally transmitted), delicate obligate parasite
- **Stages of Syphilis:**
  - 1. **Primary Chancre** lesion is the main sign
  - 2. **Secondary rash**
  - 3. **Latent**, no sign but bacteria present
  - 4. **Tertiary**, very complicated systemic
- *Treponema pertenue*, causes yaws

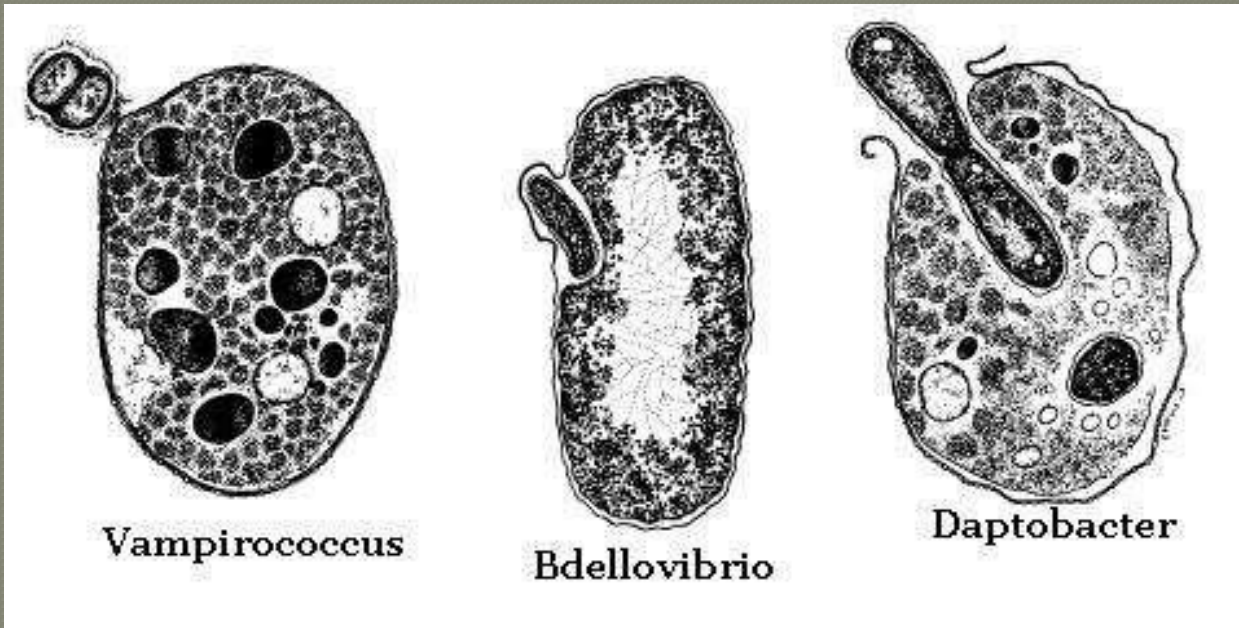


skin lesion

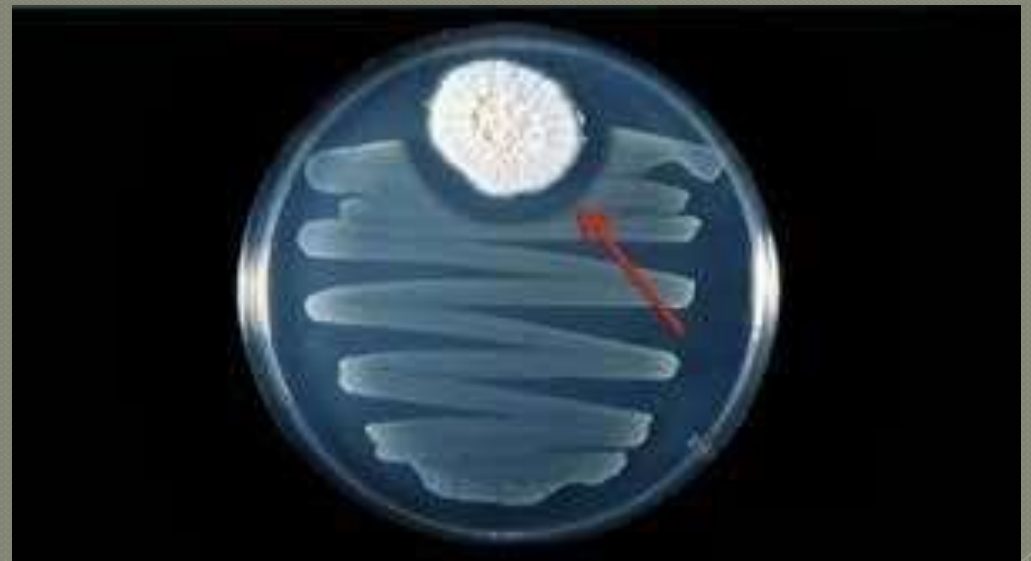
# Predation

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- It involves predator species which target other microbes for material to survive.
- Predator attacks and kills its prey.
- They can be obligate or facultative.
- Members of predatory bacteria are known as 'Bdellovibrio and like organisms' (BALO). They can be epibiotic, periplasmic, cytoplasmic.
- For eg-  
*Bdellovibrio-E.coli interaction*  
(*Vampirococcus, Daptobacter* both attack *Chromatium*).



Antibiotic production



# *Amensalism*

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- ❑ Focuses on exclusion of an organism from growing on a specific site to prevent the utilization of limiting nutrients.
- ❑ Unidirectional process based on the release of a specific compound by one organism that has negative effect on another.
- ❑ Product of one impact another i.e one species remains unaffected while other is harmed.
- ❑ For eg- microbial production of antibiotics that can inhibits or kill another. penicillin by fungi inhibit a type of cell wall found

# Cont....

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- only in bacteria.
- Bacteriocins-kill the strains of closely related species by generating holes in plasma membrane
- Metabolic end products.



# Competition

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- ❑ It arises when different organisms within population try to acquire same resources.
- ❑ Both the species are harmed.
- ❑ Competition within the species or among different species can be attributed to availability of Nitrogen source, carbon source, electron donors, electron acceptor, vitamins, light, water.
- ❑ Competition may result in exclusion of other species or the establishment of a steady state where multiple species coexist.

# Cont.....

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- ❑ Eg- In aquatic environment where extensive phototrophic activity results in blooms of single species of diatoms or cyanobacteria.
- ❑ Thermophilic springs chemolithotrophic organisms are selected.
- ❑ Lactic acid fermentation of food.
- ❑ Large intestine of animals, a single species doesn't dominate but a mixed population coexist.

# Syntropism

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Two species are required for growth on a specific electron donor that is not metabolized by either organism alone or one of the organisms remove end products of metabolism from other, which enables both the organisms to grow.

Both the species are benefited.

This relationship was discovered by Meyer Wolin and colleagues, when fermentation of propionic acid occurred when there was a coculture.

*Synophobacter* produces H during fermentation and accumulation of H makes the reaction thermodynamically unstable.

Presence of methanogen, *Methanospirillum* makes the oxidation favourable by consuming the H.'

## Hydrogen-Producing Microbe

## Hydrogen-Consuming Microbe

